

27. The process of claim 19, wherein said droplet nozzles are arranged annularly and the ammonia gas is laterally blown against the falling droplets from the exterior of the annular arrangement of the droplet nozzles. --

#### REMARKS

Reconsideration and allowance of all claims in view of the above amendments and remarks below, are respectfully requested.

Claims 19-27 are now pending in this application. Claims 19-23 have been amended and claims 26 and 27 have been added in response to the rejection under 35 U.S.C. § 112, 2<sup>nd</sup> paragraph, to better define the claimed invention, and are not intended for the purpose of overcoming rejections over prior art. Support for the amendments to claim 19 are found in the specification at page 6, lines 28 (i.e., annular) and page 10, lines 25-27 (i.e., 10 droplet nozzles). Support for the amendments to claims 20-23, and similar amendments to claim 19, is found in the application title and throughout the specification. Support for new claims 26 and 27 is found in the specification at page 6, lines 28-31. No new matter has been added by these amendments.

Applicants' claimed invention is drawn to a novel process for the production of substantially spherical aluminum oxide beads. The process involves passing an acidic aluminum oxide solution or an acidic aluminum oxide suspension through a vibrating annular nozzle plate, having at least 10 droplet

nozzles, which produces aluminum oxide (i.e., hydrosol) droplets that fall from the nozzles of a vibrating plate. The falling droplets pass through an ammonia gas stream, which is blown laterally against the falling droplets, in order to evenly gel the surface, thereof, into a substantially spherical shape. The droplets then fall into an aqueous ammonia solution, in which the droplets are coagulated to form substantially spherical aluminum oxide beads. The aluminum oxide beads are then removed from the solution.

**Rejections Under 35 U.S.C. § 112 (2<sup>nd</sup> Paragraph)**

Claims 19-25 stand rejected under 35 U.S.C. § 112, 2<sup>nd</sup> paragraph for allegedly being indefinite, for not specifically reciting the location of the ammonia gas stream with respect to the nozzles on the vibrating droplet nozzle array. Applicants have amended claim 19 to recite that the vibrating nozzle plate is annular and that the pipe that carries the ammonia gas which is blown against the falling droplets of aluminum oxide, is positioned a distance below the opening of the droplet nozzles. Claims 19-23 have also been amended to correct the inadvertent omission of the word "oxide" after each occurrence of 'aluminum', therein. These claims now recite that the beads are 'aluminum oxide' beads.

New claims 26 and 27 specifically recite that the droplet nozzles are arranged annularly and that the ammonia gas stream is directed at the stream of droplets falling from the nozzle plate, from either the inside or outside of the annularly

arranged droplet nozzles. In view of the above amendment, applicants submit that the rejection has been overcome, and withdrawal of this rejection is respectfully requested.

**Rejections Under 35 U.S.C. § 103(a)**

Claims 19-25 stand rejected under 35 U.S.C. § 103(a), as allegedly being obvious over Bezzi, et al., (U.S. Patent No. 4285645), Takumi, et al. (U.S. Patent No. 4,309,312) and Sanchez, et al. (U.S. Patent No. 4,179,408) taken together with Landis (U.S. Patent No. 4,190,622) and DeHaven, et al. (U.S. Patent No. 2,968,833). The Examiner asserts that the combined references provide one of ordinary skill in the art with the motivation to combine the teachings thereof, in a manner that renders applicants' claimed invention obvious. Applicants respectfully traverse this rejection for the reasons stated below.

Bezzi discloses a generic process for producing microspheres, whereby a solution is passed through a perforated disc that forms a liquid stream, which is converted into droplets by a vibrating means (column 2, lines 56-60). The perforated disc is described and shown in the figure of the Bezzi disclosure, to have a single perforation, forming a single liquid stream. There is no suggestion in Bezzi that an annular nozzle plate having at least 10 droplet nozzles, as claimed, should be advantageously used.

The formed droplets fall through a conical shaped chamber, where the droplets take on a spherical shape. After

passing through the conical shaped chamber, the falling droplets pass through a reactive gas stream, in order to start the solidification process. The falling droplets then fall through a layer of foam and into a reactive liquid, underneath the foam layer, wherein the microparticle solidification process is completed. The Bezzi process specifically discloses the formation of only uranyl nitrate, and is silent as to the formation of microparticles of other compositions. There is also no teaching or suggestion, in the Bezzi disclosure, of using a vibrating annular nozzle, having at least 10 droplet nozzles to generate the falling droplets.

Applicants' claimed process is distinguished from the disclosure of Bezzi because the Bezzi reference is silent with respect to any mention of preparing aluminum oxide beads, using a vibrating annular nozzle plate having at least 10 droplet nozzles, as claimed by applicants.

Absent some teaching or suggestion in the Bezzi reference to make aluminum oxide beads, using a vibrating annular nozzle plate, having at least 10 droplet nozzles, as claimed by applicants, one of ordinary skill in the art would not be led to modify the apparatus of Bezzi, to specifically obtain applicants' claimed aluminum oxide beads in the manner claimed. The Examiner asserts that the disclosures of Sanchez and Takumi, teach the formation of aluminum oxide beads by a "drop method", and therefore, allegedly provides motivation to one of ordinary skill in the art to combine these teachings with that of Bezzi. Applicants respectfully traverse this

assertion.

Sanchez discloses a process for the production of spheroid alumina particles by dropping the droplets of alumina through air, and into an organic liquid. By contrast, Bezzi prepares microspheres of uranyl nitrate, which fall through a reactive gas stream (i.e. ammonia), and then fall into an aqueous solution of ammonium hydroxide. The two processes are separate and distinct from each other. The Bezzi process requires a reactive gas stream and an aqueous solution and the Sanchez process requires an organic solution; there is no teaching or suggestion from either reference that the respective solutions are interchangeable. Further, there is no suggestion or teaching, from either Bezzi or Sanchez, that the alumina particles produced by Sanchez, can be produced using the apparatus of Bezzi.

Takumi discloses the formation of aluminum oxide beads by an "oil drop" process, wherein the droplets of aluminum oxide are mixed with a gelling agent and then dispersed in a suspension medium which is immiscible with water (i.e., paraffin oil), wherein the particles harden and are allowed to age. See column 3, line 21 to column 4, line 2. This process is also distinct from that disclosed in the Bezzi.

The Takumi disclosure does not suggest or teach that the apparatus of Bezzi is suitable for use in the Takumi process. Similarly, the Bezzi disclosure does not appear to teach or suggest that the paraffin oil of Takumi can be used in the apparatus of Bezzi, or that the aqueous reactive liquid of

Bezzi can be substituted for the paraffin oil in the Takumi process.

One of ordinary skill in the art, having these three references would not be motivated to combine the disclosures in a manner that would render applicants' claimed process obvious, without some teaching or suggestion of how to combine the disclosures. Even if the disclosures were combinable, the combination would not result in the process as claimed by applicants, because the disclosures are divergent with respect to the type of solution into which the falling droplets fall. Additionally, there is no teaching or suggestion from any of the cited references supporting or suggesting that the respective solvents, into which the droplets fall, are interchangeable from one process to the other.

The specification herein teaches an advantage of the claimed invention is that organic liquids are not needed, leading to cost savings and environmental advantages (specification, page 7, lines 5-10). Thus, the secondary references, Sanchez and Takumi, teach away from the claimed subject matter, and the Examiner's combination of references fails.

With respect to applicants' claimed vibrating annular nozzle plate, having at least 10 droplet nozzles, the Examiner asserts that the combined teachings of Bezzi, Landis and DeHaven render applicants' claimed vibrating annular nozzle plate obvious. Applicants disagree with this assertion because Landis and DeHaven disclose a process for making

beads of urea and ammonium nitrate, respectively, using apparatus which are structurally distinct from that disclosed by Bezzi.

Landis discloses a process for the producing beads of urea, from molten urea, which is sprayed through a nozzle, into a prilling tower containing a suitable gas atmosphere. As the molten urea droplets fall through the prilling tower, the droplets solidify, and collect on an air-fluidized bed at the bottom of the tower. The urea beads are then are removed from the tower.

Landis, however, does not teach or suggest the use of a vibrating nozzle plate, as claimed by applicants, to form the molten droplets of urea. Nor does Landis teach or suggest that the falling droplets fall into an aqueous ammonia solution, as claimed by applicants.

DeHaven discloses a process for the production of ammonium nitrate beads, from a solution of ammonium nitrate. The ammonium nitrate solution is passed through a vibrating nozzle to form droplets of ammonium nitrate, which then fall through a prilling tower, having an air atmosphere contained therein. The falling droplets solidify during their descent and are collected at the bottom of the tower and are removed on a conveyor belt. While a vibrating nozzle plate is disclosed by DeHaven, there is, however, no disclosure of the droplets falling into an aqueous ammonia solution, as claimed by applicants.

The process disclosed by Bezzi requires that (i) the

falling droplets pass through a reactive gas stream (i.e., ammonia) and (ii) fall into an aqueous reactive liquid. There is no teaching or suggestion, in the Bezzi reference, of using an annular vibrating nozzle plate, as claimed by applicants, to form the droplets that will become the product beads.

Absent any teaching or suggestion to use an annular vibrating nozzle plate, one of ordinary skill in the art would not be led to the teachings of Landis and/or DeHaven. Further, since no aqueous solutions are used in Landis or DeHaven to solidify the droplets, the processes of Bezzi, Landis and DeHaven, therefore, are not combinable.

While it may appear obvious to try incorporating the nozzle of Landis and the vibrating nozzle plate of DeHaven, into the process of Bezzi, obvious to try is not the proper standard of obviousness under 35 U.S.C. § 103. It has been held that obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive, within the prior art, supporting the combination. *In re Geiger*, 2 USPQ2d 1276, 1278 (CAFC 1987). Further, it must be apparent that the teachings of the prior art can be combined, in order for a combination of references to render applicants' claims obvious. *In re Avery*, 186 USPQ 161, 165 (CCPA 975).

The processes disclosed by Landis and DeHaven for making the product beads, are distinct from that disclosed by Bezzi. There is no teaching, suggestion or incentive in any of the cited references, to lead one of ordinary skill in the art to

combine specific components of three distinct apparatus, into a single apparatus, for specifically making aluminum oxide beads, in the manner claimed by applicants. The structural distinctions of the Landis and DeHaven processes, additionally, do not suggest that the elements specific to each, are combinable with the Bezzi process.

Further, there is no suggestion from either of Bezzi, Landis or DeHaven, that gas phase cooling of the droplets can be substituted for the liquid phase cooling and solidification of the droplets in the apparatus of Bezzi. Neither is there a teaching or suggestion that the vibrating nozzle arrangement of Landis and/or DeHaven can be, or should be, incorporated into the apparatus of Bezzi.

Lastly, the Examiner's assertion of obviousness is based on the fact that each of the cited references individually discloses some element of the claimed invention. The Examiner alleges that since elements of applicants' claimed invention are known in the art, it would have been obvious to combine the teachings of the cited prior art and obtained the claimed invention. This, however, is not a proper standard for concluding obviousness. It has been held by the Board of Patent Appeals and Interferences and the Federal Circuit, that citing references which merely indicate that isolated elements and/or features recited in the claims are known, is not a sufficient basis for concluding that the combination of claimed elements would have been obvious. *In re Hiyamizu*, 10 USPQ2d 1393, 1394 (BPAI 1988), *ACS Hospital System, Inc. v.*

*Montefiore Hospital, 221 USPQ 929, 933 (CAFC 1984).*

Applicants' claimed invention, therefore, is not made obvious by the combined teachings of the above cited references, as alleged by the Examiner. One of ordinary skill in the art would not be led to the claimed invention by the combined teachings of the above cited references because: (i) there is no suggestion to combine the cited references and (ii) there is no teaching of how the prior art disclosed elements should be combined in order to obtain the claimed invention. Withdrawal of this rejection is respectfully requested.

**CONCLUSION**

Having fully responded to the Office Action dated January 22, 1999, applicants submit that all claims are now in condition for allowance. Favorable notification thereof is earnestly solicited.

The Examiner is invited to contact the undersigned, to resolve any questions concerning the patentability of the pending claims.

Respectfully submitted,

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